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Yield Performance of Calocybe indica on Different Agricultural Subatrate

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Abstract

The Milky mushroom, Calocybe Indica was cultivated on the different agricultural substrate, paddy straw, wheat straw, sugarcane trace, and mango dry leaves. The spawning was done by sterilization of all the four substrates. The bags were kept in a mushroom growing room with the maintenance of temperature and humidity 30° c-35° c and 70-80 % respectively. The minimum days requires for completion of spawn run (18.4 days), primordial formation (25.2 days) and days for first harvest (32.4 days) was first observed on cultivation with Paddy straw. The maximum yield on fra esh weight basis and biological efficiency (134.86 %) was also found to be as the same treatment with the Paddy straw as a substrate. The biological efficiency of wheat straw was at par with Sugarcane trace as sua bstrate which was 85.07 % and 85.02 % respectively.

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1. Introduction

Calocybe indica is the third important commercially grown mushroom in India after button and oyster mushroom. Ever increasing production in mushroom-like Calocybe *indica* pose a challenge to the current supremacy of button mushroom in the world market (Miller, 1994). Taxonomic position of milky mushroom falls in Phylum-Basidiomycota, Class-Agaricomycetes, Order-Agaricales, Family-Tricholomataceae, Genus-Calocybe and Species-Indica. It is normally growing on Humus and at high temperature on summer season. The milky mushroom can be cultivated on varieties of cellulosic substrates like paddy straw, wheat straw, maize stalks, sorghum stalks, pearl millet stalks, sugarcane trace, sugarcane bagasse, soya bean straw, cotton waste, coconut coir pith, groundnut haulms etc. The casing is the most important factor affecting the yield after substrate. It is the process for applying nourishment layer of soil-compost mixture on the open surface of a fully spawn run bag is called casing. The factors

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which determine the quality of casing layer include texture, structure, pH, water holding capacity, porosity, gaseous exchange capacity, and C: N ratio which directly affect the mycelia growth in casing layer and initiation of the fruit body. This layer is important for water supply to the bottom layer but also provides physical support for the development of fruiting bodies. The preferred casing material is soil, sand, cow dung, horse dung, rice husk, and compost.

2. Materials and Methods

2.1 Pure culture, spawn, substrate and casing material preparation

The ultimate goal, of course, is to start with one mushroom fruit body and turn it into a bunch of fruit bodies. The seeds of mushroom are called spawn. For culture preparation, Potato dextrose agar medium was used. Tissue from mature fruit body was aseptically placed on culture medium. The slants are maintained in the incubator at 25± 2° C for one week. This pure culture were used to make spawn. Spawn preparation was done by using sthe tandard method described by Krishnamoorthy (2003), S.K. Singh (2003). Method starts with bthe oiling of healthy and clean wheat grain until it absorb water and get double in size. It is then allowed to cool and excess water was removed. Grains are mixed with chalk powder and gypsum in order to prevent aggregation and to maintain required pH. Nonabsorbent cotton was plugged and autoclaved at 21 p.s.i for 1.5 to 2 hrs. It was inoculated after cooling and incubated at 23 ± 2° C for 15 ti 20 days. As the grain fully covered with mycelium it is ready for spawning the substrate.

The substrate such as paddy straw, wheat straw, soybean straw, and sugarcane bagasse were chopped into 2 to 3-inch pieces and soaked in water containing Carbendazim (75 ppm) and Formalin (500 ppm) for 14 - 18 hours. After that, the substrate was taken out from the solution and excess water was drained out for 2-3 hrs. While cotton waste and coconut coir pith were used as such with overnight soaking. A moisture content of about 60 percent was maintained in the wet substrate prior to spawning. Spawning was done @ 4 percent by wet weight of the prepared substrate. Cultivation was done in high-density polyethylene bags 60cm x 40cm with 100 gauges (Pani and Das, 1998).

Casing mixture was prepared by using FYM and Soil (1:1). After mixing both the substance in equal amount, the pH was adjusted to 8.0 by using $CaCo_3$ or $CaSo_4$. The mixture was treated with 4% formalin solution and covered with a plastic sheet for 72 hrs. The casing material was sterilized at 65° C for 4 hrs. (Tondon *et al*., 2006). Thickness of casing material was maintained about 1.5 cm. The experiment was laid out as a completely randomized design with five replication and four treatments. T_1-Paddy straw, T_2-Wheat straw, T_3- Sugarcane trace and T_4- Mango dry leaves. Biological efficiency of mushroom on the fresh weight basis was calculated by the formula given by Chang and Miles (1989).

3. Results and Discussions

Table 1
Growth parameter of *Calocybe indica* with different treatments

Treatments	Spawn run (days)	Primordia formation (days)	Harvest (days)	Stem length (cm)	Cap diameter (cm)
T1	18.4	25.2	32.4	7.39	7.10
T2	20.2	29.2	35.8	6.85	6.65
T3	21.4	34	41	6.51	6.31
T4	26.4	40	47	5.86	5.47
S.E.M	0.48	0.69	0.82	0.06	0.06
CD	0.69	1.41	2.02	0.01	0.01
CV %	4.96	4.78	4.70	2.02	2.25

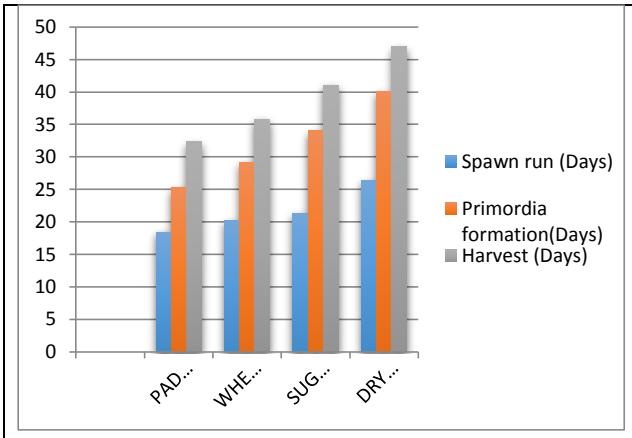

Chart:1 Spawn run, primordial formation and the first harvest of *Calocybe indica*

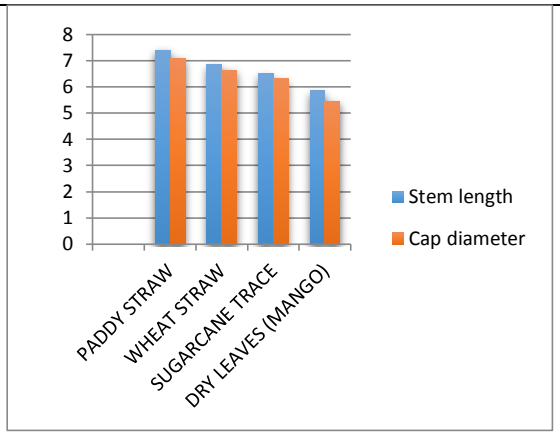

Chart: 2 Stem length and cap diameter of *Calocybe indica*

Table 2
Yield parameter of *Calocybe indica* with different treatments

Treatments	1st harvest (gm)	2nd harvest (gm)	3rd harvest (gm)	Total yield(gm)	Biological efficiency (%)
T1	207.97	122.4	74.2	405	134.86
T2	163.83	90.4	43.5	298	85.07
T3	139.43	79.32	36.3	255	85.02
T4	107.89	56.44	21.9	186	37.25
S.E.M	2.61	1.22	0.97	3.43	0.97
CD	20.46	9.93	2.80	35.19	2.84
CV %	3.77	4.67	4.92	2.68	2.55

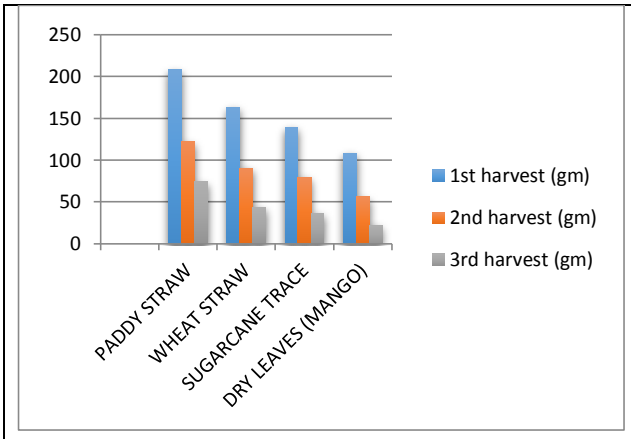

Chart: 3 First, the second and third harvest of *Calocybe indica*

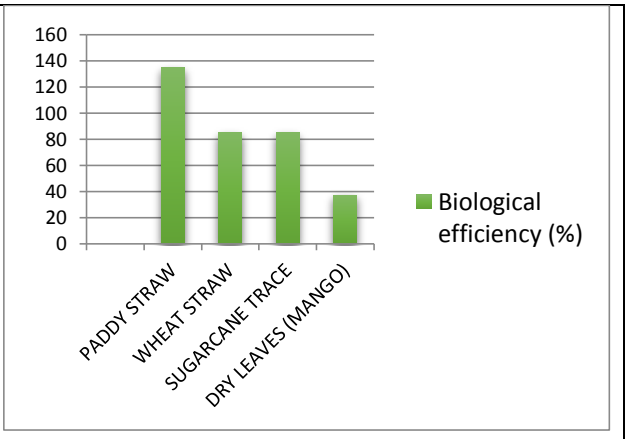

Chart: 4 Total yield and biological efficiency of *Calocybe indica*

By evaluating different substrate for cultivation of *Calocybe indica,* result obtain is discuss below.

Spawn run: Significant results were observed among treatments in terms of days taken for spawn running. The days taken for spawn run on different substrates ranged from 18.4 days to 25.8 days. Minimum days required for

spawn run in T_1 (Paddy Straw) was 18.4 days. The next best in order was T_2 i.e. 20.2 days. This treatment was at par with T_3 i.e. 21.4 days. Maximum days required for spawn run in T_4 i.e. 25.8 days.

Primordia formation: The result reveal significant over days required for primordial formation presented in table 1. The result indicates that 25.2 to 40 days required for primordia formation. The best result found with the T_1 treatment i.e.25.2 days. The next best in order was observed in T_2 i.e. 29.2 days followed by T_3 i.e. 34 days. Maximum days were observed in T_4 treatment i.e.40 days.

Days for the first harvest: The days required for the first harvest ranged from 32.4 to 47 days. Minimum days required in T1 (Paddy straw) i.e. 32.4 days which was at par with T_2 (Wheat straw) i.e.35.8 days. Which was followed by T_3 (Sugarcane trace) i.e. 41 days? The result revealed that maximum days observed in T_4 (Mango dry leaves) i.e. 47 days.

Stem length: The result on the length of the stem was presented in table 1. The results reveal that the significantly highest length of the stalk was observed in the treatment of paddy straw (T_1) i.e.7.39 cm. The next best in order was T_2 (6.85 cm) followed by T_3 (6.51 cm). The minimum stem length was recorded in T_4 (5.86 cm).

Cap diameter: There was a significant result observed in cap diameter with a different substrate. The highest cap diameter was recorded in Paddy straw (T_1) i.e. 7.10 cm which was followed by Wheat straw (T_2) i.e. 6.65 cm and Sugarcane trace (T_3) i.e. 6.31cm. Lowest cap diameter was recorded in treatment T_4 (Mango dry leaves) i.e. 5.47 cm.

Total yield and B.E: Significant result obtained by evaluating different substrate in this parameter. Maximum yield was recorded in T_1 substrate (405 gm). The next best in order was T_2 substrate (298 gm) which was at par with T_3 substrate (255 gm). The minimum yield was recorded in T_4 substrate (186 gm). Maximum B.E 134 % was recorded in T_1 (Paddy straw) and minimum B.E 37 % was recorded in T_4 (mango dry leaves).

Amin *et al.* (2010) reported the morphology of *C. indica* based on the length of the stalk, the diameter of the stalk, pileus and thickness of pileus *i.e.* 9.26 cm, 2.83 cm, 6.53 cm and 2.10 cm on rice straw substrate respectively. Pani *et al.* (2010) mentioned that sporophore of *C. indica* was milky white with large sized fruiting bodies. Tewari (1991) provided an evidence for a relationship between spawn rate and sporophore yield in Pleurotus sajor-caju which implied that 4% and 6% of spawn on wet weight basis have enhanced maximum sprophore yield during summer and winter season respectively. Similarly, Calocybe indica yielded more at 4% spawn rate (Doshi *et al.,* 1993). In the present experiment paddy straw found to be a good substrate for cultivation of milky mushroom which is in agreement with earlier reports of several scientists. Highest yield performance of milky mushroom was observed Krishnamoorthy and Muthusamy (1997), Biswas and Singh *et al.* (2009), Pani (2010) and Saranya *et al.*, (2011) who had reported that paddy straw was the best substrate for cultivation of *C. indica*. Whereas, the next best option was wheat straw. (Tandon and Sharma (2006), Arora *et al.,* (2007) and Dayaram (2009), Similarly, minimum days required for spawn run and for pinhead formation were seen on wheat straw for *C. indica* (Bhatt *et al.,* (2007), Chaubey *et al.,* (2010) and Sharma *et al.,* (2011).

4. Conclusion

The present research work was carried out to observe the yield potential of Calocybe indica on the different locally available cheap agricultural substrate. The result shows cultivation of Calocybe indica mainly depends on the different substrate on which it is cultivated and the result found to be the sign for all the parameter. By focusing on yield and biological efficiency parameter, paddy straw found to be the best-suited substrate for cultivation. The varied production potential of different substrates is due to the variations in their physical properties and nutritional composition.

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Statement of authorship
The author(s) have a responsibility for the conception and design of the study. The author(s) have approved the final article.

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